

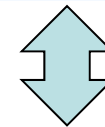
The NACIR Project (research, technology development and demonstration) **NEW APPLICATIONS FOR CPV'S: A FAST WAY TO IMPROVE RELIABILITY** **AND TECHNOLOGY PROGRESS**

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Universidad Politécnica de Madrid

Renewable Energies: Technologies and Efficient Management
12-13th January 2012
Al-Ahkawayn University
Ifrane , Morocco



- Based on a competitive **Grant Agreement between the UPM and the European Commission** , which is subsidizing more than 50% of total project cost.
- **Funding Scheme:** Collaborative project with the participation of EU and Mediterranean countries .
- **Area of Research: CONCENTRATOR PHOTOVOLTAICS:** New Applications for CPV's, reliability improvement and technology progress
- **Duration :** 4 years : January 2009 - December 2012
- **Partners:**



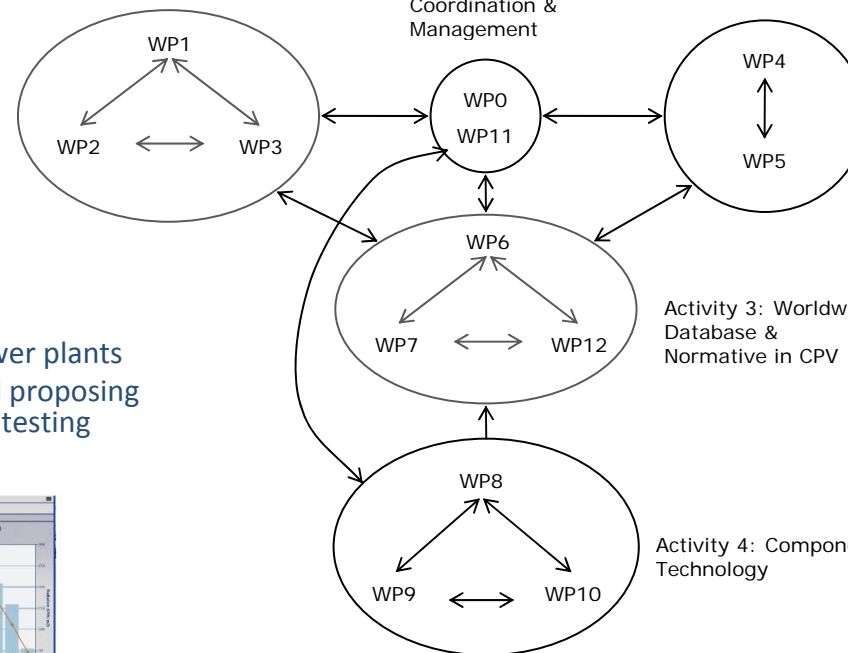
Activities 1 and 2:

- Installations of CPV Systems in Egypt and Morocco



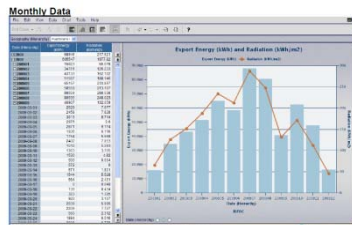
Activity 1 : "Egypt" or Stand Alone CPV

Activity 2: "Morocco " or Grid connected CPV



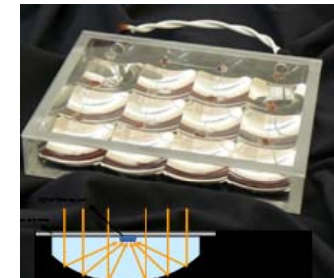
Activity 3:

- Testing CPV Systems
- Recording data of power plants
- Defining methods and proposing standards for module testing and power rating



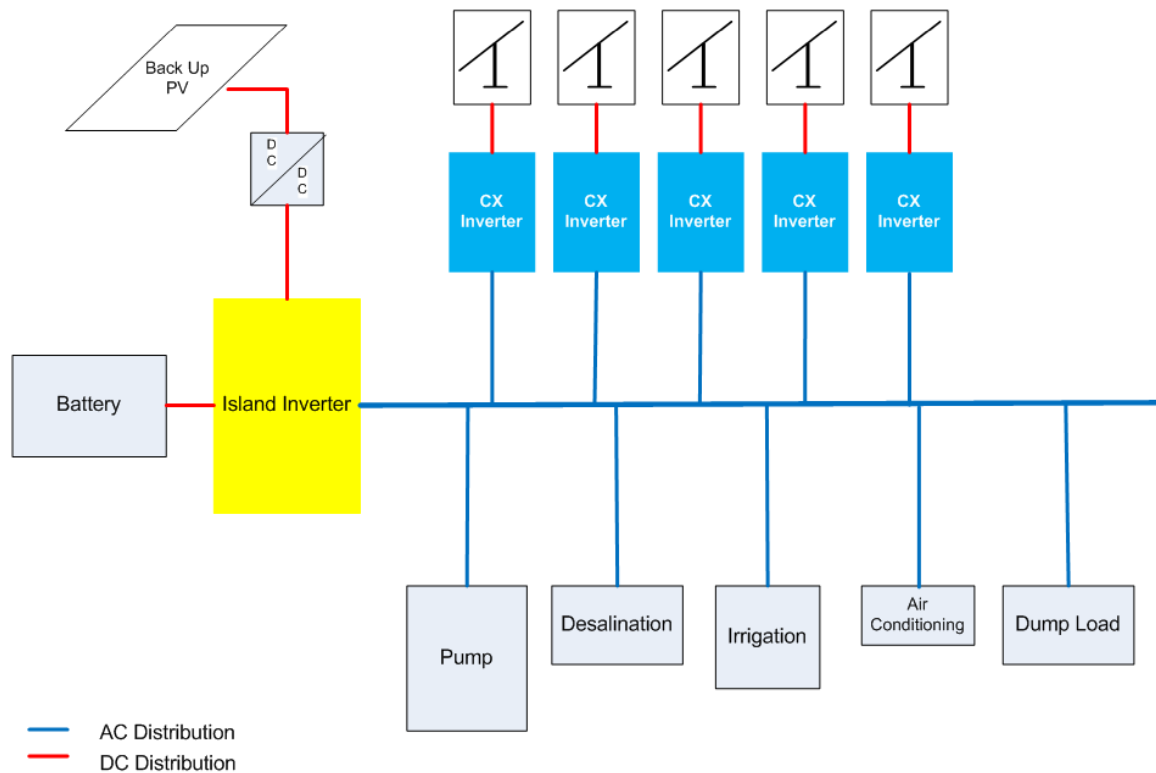
Activity 4:

- Second generation CPV modules at Concentrix
- Second generation CPV modules at ISOFOTON
- Development of new FLUIDREFLEX module technology



System design: AC coupled island system

The protocol **UESP** (Universal Energy Supply Protocol) developed by Fraunhofer Institut allows the inclusion of different generation sources such as photovoltaics, wind, diesel, etc.



Stand Alone operation
become a
“Particular Case”
Of
General AC operation

System installation in Egypt has been completed by Concentrix and NWRC

First worldwide stand alone CPV



NACIR: Wadi El Natrun

Five Concentrix trackers with a total maximum power of 30 kW inverter have been installed on site in Wadi El Natrun to power the stand alone irrigation system

Main pump in operation

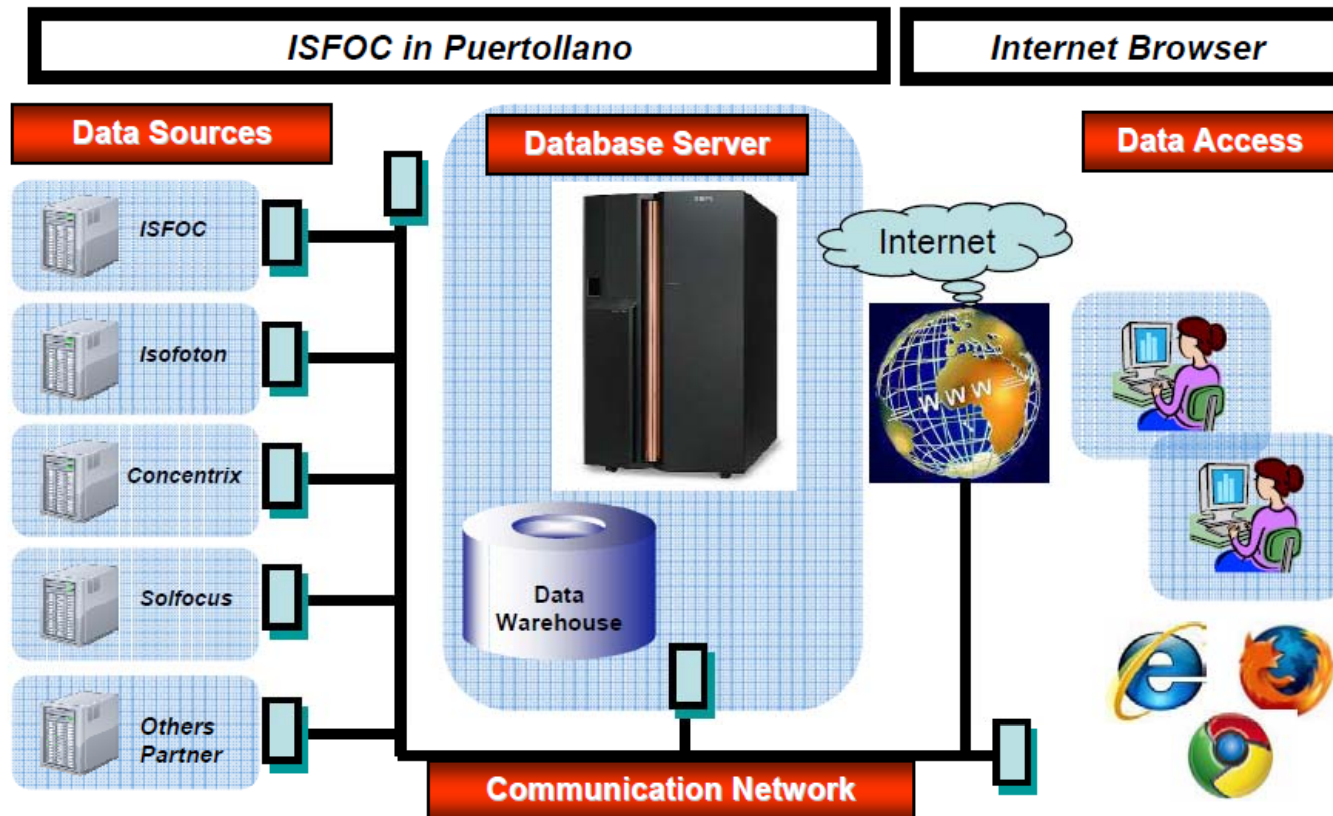


Activity 2: Grid connected CPV in Morocco

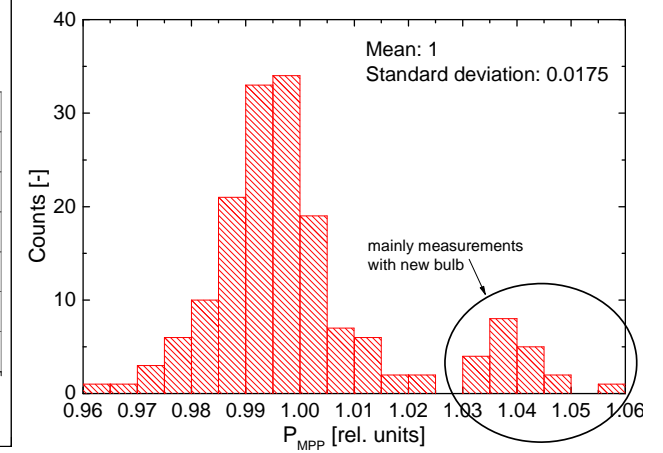
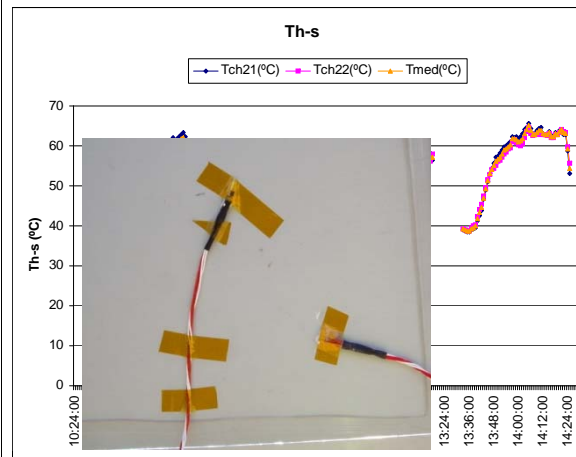
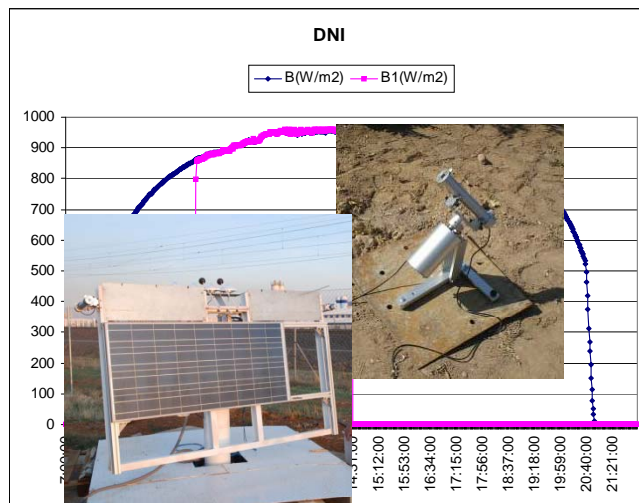
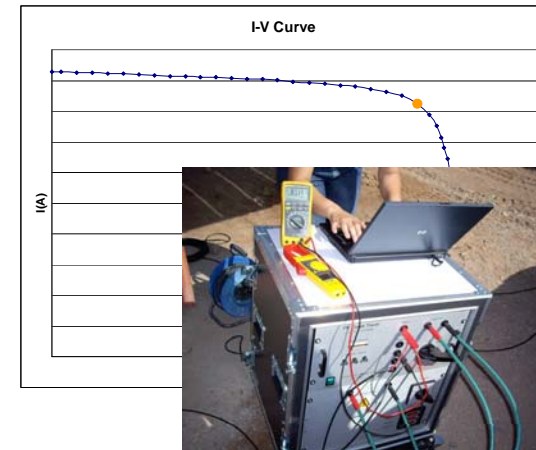
- The power Plant in Morocco has been deployed in the Campus of the University Al Akhawayn which has reached an agreement with ONE.
- The system installation was completed (ISOFOTON) and connected to the grid one year ago. During 2011 it has been operated and tested. The hard environmental conditions at Ifrane will accelerate the reliability and performance analysis



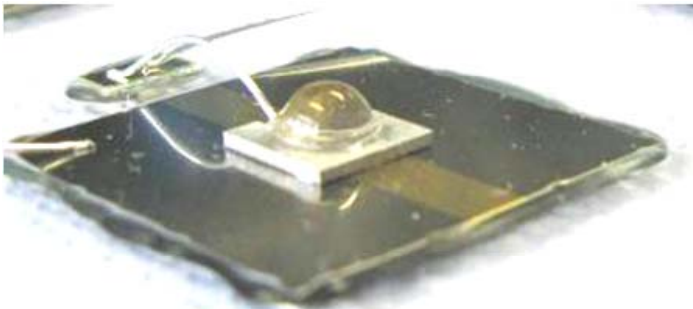
- ISFOC is recording meteorological and production data from several technologies (7 + 2 NACIR) and storing them in a data base



Power, I-V Curve	I-V Curve Tracer
DNI, spectral DNI	2 pyrliometer, heliometers on independent tracker
Back plate temperature behind the cell, translation ecuations	Thermal sensors (thermocouple, pt-100)



- **Second generation CPV modules at Concentrix**
 - Acceptance Angle: $\pm 1^\circ$
 - Concentration ratio: 600-800X
 - New optical design with integration of a secondary element

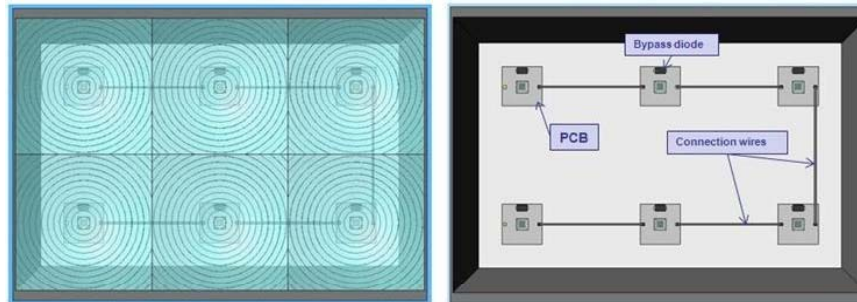
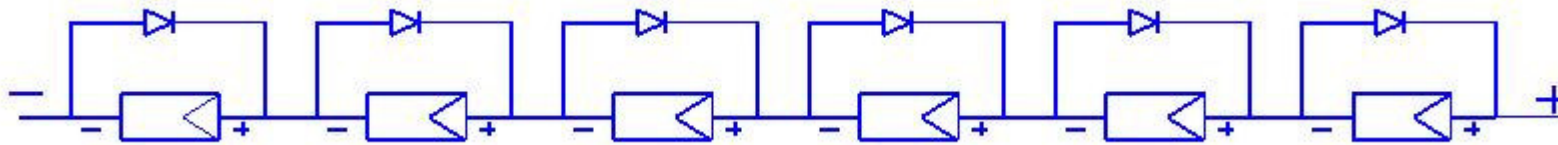


Solar cell assembly with mounted glass secondary

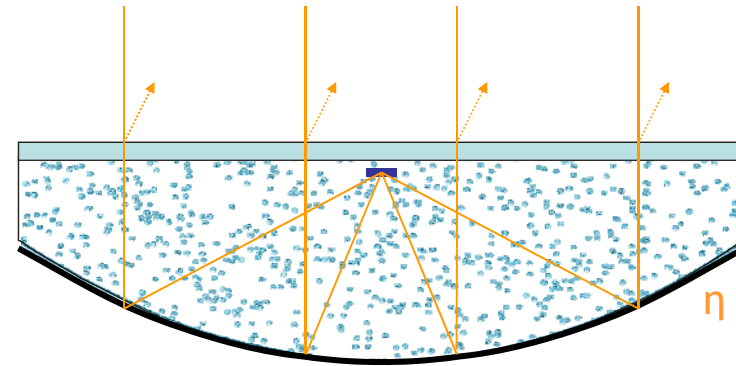
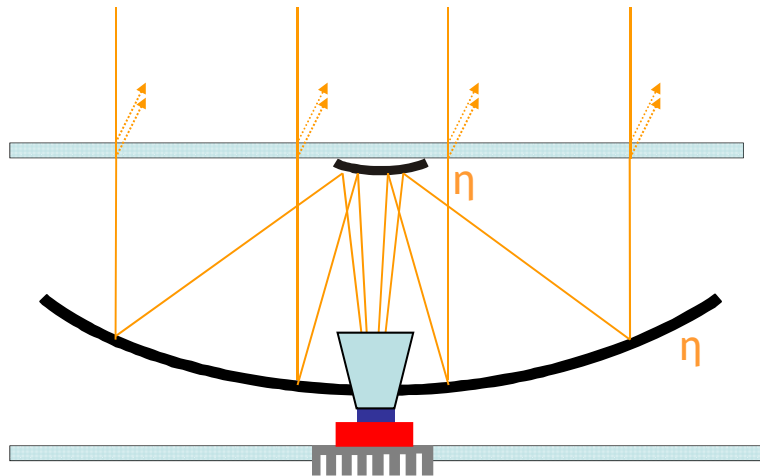
Prototype module with two optical stages.
(Franhofer ISE & Concentrix)



- **Second generation CPV modules at ISOFOTON**
 - New optical design (Primary and secondary)
 - Serial cell connections with by-pass diode



Main task : Highly automatic manufacturing set-up is being adapted to this module



Losses	Cassegrain	FluidReflex
Fresnel air-glass interface	0.96	0.96
Fresnel glass-air interface	0.96	-
Fluid Absorbance	-	0.98
Primary mirror reflectivity	0.85	0.85
Secondary mirror reflectivity	0.85	-
Theoretical optical efficiency (Al mirror)	0.67	0.79

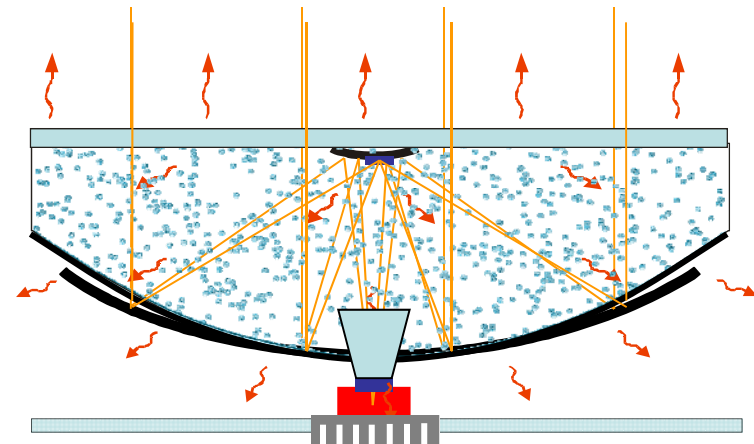
✓ Index adaptation improves optical efficiency
No secondary optics required

✓ Cooling elements unnecessary
No heat sink required

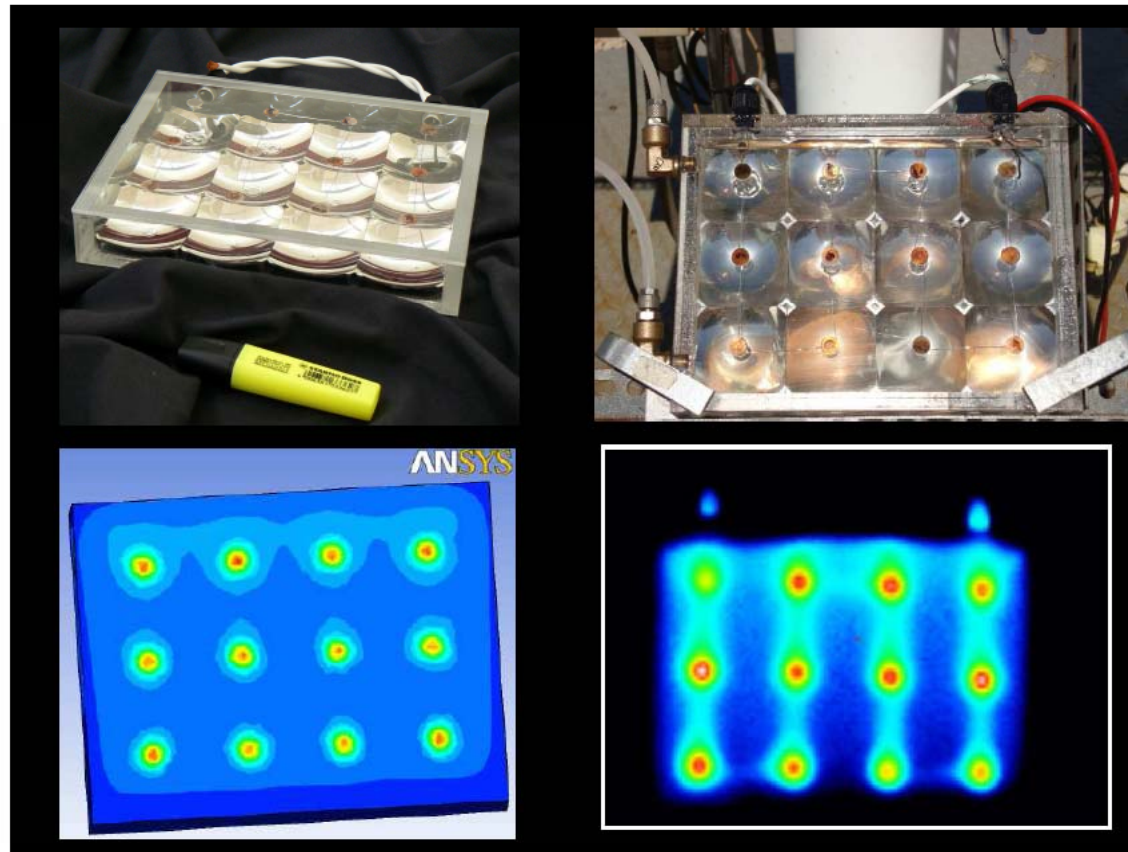
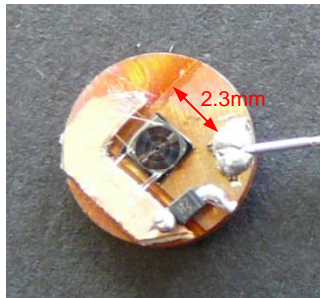
✓ Improved electrical insulation
No insulator substrate required

✓ No water vapor condensation
Cell sealing or air drying not required

✓ Two sides heat dissipation
Better heat exchange



- A prototype with 12 elementary units has been constructed and tested



First FluidReflex
Prototype
module

Experimental
thermal
performance

Measured optical efficiency (silver mirror) : **83% a@ 1000X**

- Increase the acceptance angle of CPV modules
 - Minimize the misalignment losses
 - Reduce the rigidity requirements for modules and trackers
 - Improve the AC production
- Development of a new concept of Compact Concentrator (FLUIDREFLEX)
- Apply the UESP protocol in a real installation
- Monitoring solar spectrum using isotype cells
- Comparison of the outdoor performance of MJ3 modules vs indoor rating characteristics
- New applications for CPV: stand alone
- Contribution to the knowledge and deployment of CPV technologies in the Mediterranean countries
- Obtain experience of CPV systems operation in hard environmental conditions as those found in Morocco and Egypt.

- The partners of NACIR Project thanks :
- To European Commision for the grant Agreement within 7th Framework Program
- To Partners ONE and AUI for hosting the 6th Semester meeting of the Project in IFRANE
- And also , again to AUI, and all sponsors for organizing and supporting this conference sided to NACIR meeting
- And finally for giving us the opportunity for disseminating the purposes , results and achievements of the project.
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